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Precision Laser and Linac Technologies for Nuclear Photonics Gamma-Ray Sources[1]

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Tunable, high-precision gamma-ray sources are under development to enable nuclear photonics, an emerging field of research. This presentation focuses on the theoretical and technological challenges related to precision Compton scattering gamma-ray sources. In this scheme, incident laser photons are scattered and Doppler upshifted by a high-brightness electron beam to generate tunable and highly collimated gamma-ray pulses. The electron and laser beam parameters can be optimized to achieve the spectral brightness and narrow bandwidth required by nuclear photonics applications. detailed presentation of the Compton scattering mechanism and theoretical modeling will be followed by a description of the design of the next generation precision gamma-ray source currently under construction at LLNL. Within this context, high-gradient X-band technology used in conjunction with fiber-based photocathode drive laser and diode pumped solid-state interaction laser technologies, will be shown to offer optimal performance.

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